74. Thereafter, the mating card edge 18 contacts the signal terminal lead-in surfaces 100 and deflects or separates the signal terminal contact arms 94. Peak insertion forces are reduced by separating these two contact engagement actions.

The card edge connector 12 of the present invention provides an advantageous array of circuit paths between the circuit board 14 and the terminals 60 and 62. FIG. 9 illustrates a fragmentary portion of the circuit board 14 showing the array of plated through hole conductive regions 24 through which extend board contacts 72 and 92. A reference line 108 identifies the longitudinal centerline of the array, coinciding with the longitudinal centerline of the slot 34 and the center of the inserted circuit card 16. An important feature of the circuit path array is that all the circuits are symmetrical about this centerline 108.

The conductive regions 24 and the board contacts 72 and 92 inserted therein are located in four lines all parallel to the centerline 108, two inner lines 110 and 112 and two outer lines 114 and 116. The inner lines 110 and 112 are closer to the centerline 108 than are the outer lines 114 and 116. In the preferred embodiment, the lines 110, 112, 114 and 116 are equally spaced, but if desired the lines 110 and 112 could be spaced farther apart while maintaining symmetry around the centerline 108.

The inner lines 110 and 112 of conductive regions 24 receive only the contacts of a single type of terminal and the outer lines 114 and 116 receive only the contacts of the other type of terminal. In the illustrated arrangement, the inner lines 110 and 112 of through holes 24 receive only the reference terminal board contacts 72 and the outer lines 114 and 116 receive only signal terminal board contacts 92.

Every reference terminal board contact 72 is transversely aligned with and spaced an equal distance from the centerline 108 as another reference terminal contact 72. A transverse line 118 intersects two contacts 72 and illustrates this relationship. Every signal terminal contact 92 also is transversely aligned with and spaced an equal distance from the centerline 108 as another signal terminal contact 92. Another transverse line 120 intersects two contacts 92 and illustrates this relationship.

The circuit path array resulting from the present invention can facilitate routing of conductive traces on the circuit board 14 in comparison with conventional asymmetrical circuit arrays. In addition, the symmetrical array is a characteristic of a terminal pattern that facilitates connector manufacture and assembly.

In the preferred embodiment of the invention, the board contacts 72 and 92 are solder tails that are soldered to the plated through holes 24 of the circuit board 14. Other types of board contacts such as surface mount feet may be used, while retaining the advantages of the present invention. In addition, for some applications, it may be possible to utilize only one board contact for the reference terminals 60.

While the present invention has been described with reference to the details of the embodiment of the invention shown in the drawing, these details are not intended to limit the scope of the invention as claimed in the appended claims.

We claim:

1. An electrical circuit assembly comprising a printed circuit board having a plurality of conductive regions, an electrical connector having an elongated insulated housing with a longitudinal axis, a plurality of generally planar, electrical terminals mounted in said housing, the plane of each electrical terminal being generally perpendicular to said longitudinal axis, and each electrical terminal having at least one board contact extending from said housing for connection to said conductive regions, said board contacts and said conductive regions defining a plurality of conductive paths extending between said circuit board and said connector, said conductive paths being of two types, a first type being signal paths for carrying high frequency signals and a second type being reference paths for carrying ground and power signals, each of said paths including one of said board contacts and one of said conductive regions, said paths being arrayed as follows:

said paths being arrayed solely along two opposed inner lines and two opposed outer lines, each said line being generally parallel to the longitudinal axis of said housing;

each said path in one of said inner lines being laterally aligned with a path in the other of said inner lines to define pairs of inner paths and each said path in one of said outer lines being laterally aligned with a path in the other of said outer lines to define pairs of outer paths; and

said paths of said first type all being positioned along said inner lines and said paths of said second type all being positioned along said outer lines.

2. An electrical circuit assembly as claimed in claim 1 wherein said inner lines include only reference paths and said outer lines include only signal paths.

3. An electrical circuit assembly as claimed in claim 2 wherein every pair of laterally aligned signal paths in said outer lines is laterally adjacent an aligned pair of reference paths in said inner lines.

4. An electrical circuit assembly as claimed in claim 2 wherein every pair of laterally aligned signal paths in said outer lines is laterally between two aligned pairs of reference paths in said inner lines.

5. An electrical connector assembly as claimed in claim 1 wherein said board contacts are solder tails and said conductive regions are plated through holes.

6. A card edge connector for interconnecting a printed circuit board having conductive contact regions and a removable printed circuit card having a mating edge with a plurality of conductive contact pads, said card edge connector comprising:

an elongated housing formed of insulating material and having a mating surface;

an elongated slot in said mating surface of said housing for receiving said mating edge of said circuit card, said slot having an elongated centerline therealong coinciding with the center of said circuit card when mated;

a plurality of transversely extending terminal receiving cavities in said housing, each cavity extending to both sides of said slot; and

a plurality of conductive terminals mounted in said cavities, said terminals including first and second groups of terminals, one of said groups being signal terminals for conducting signals between said contact pads of said circuit card and said contact regions of said circuit board, the other of said groups being reference terminals for making ground and power connections between others of said contact pads and said contact regions;

said terminals being generally planar and including spring arms extending into said slot for contacting said contact pads of said circuit card when inserted therein and board contacts extending from said housing for contacting said contact regions of said circuit board;

said board contacts for all of the signal and reference terminals mounted in said housing cavities being generally arrayed solely in four lines parallel to said centerline, said four lines including an inner line and an outer line on each side of said centerline;

wherein two of said board contacts extend from each cavity;

wherein both of said board contacts extending from each cavity are from the same group of terminals, said inner lines include only board contacts of said first group of terminals and said outer lines include only board contacts of said second group of terminals.

7. A card edge connector as claimed in claim **6** wherein said first group of terminals are said reference terminals and said second group of terminals are said signal terminals.

8. A card edge connector as claimed in claim **7** wherein each cavity containing at least one of said signal terminals is adjacent to a cavity containing at least one of said reference terminals.

9. A card edge connector as claimed in claim **8** wherein each cavity containing at least one of said signal terminals is between two cavities containing at least one of said reference terminals.

10. A card edge connector as claimed in claim **6** wherein said terminals are flat, planer stamped plates of metal.

11. A card edge connector as claimed in claim **10** wherein said board contacts are solder tails.

12. A card edge connector as claimed in claim **6** wherein each said signal terminal includes one of said spring arms and one said board contacts and two of said signal terminals are mounted in each cavity with one of said signal terminal on each side of said slot.

13. A card edge connector as claimed in claim **6** wherein each said reference terminal includes two of said spring arms and two of said board contacts and said reference terminals are mounted one to a cavity with said spring arms and board contacts on opposite sides of said slot.

14. A card edge connector comprising:

an elongated insulative housing including an elongated circuit card receiving slot having a longitudinal axis;

a plurality of terminal receiving cavities extending perpendicularly to said slot and extending to both sides of said slot;

a plurality of terminals mounted in said cavities,

said terminals including a plurality of identical terminal sets mounted in parallel face-to-face relation in adjacent ones of said terminal receiving cavities;

each of said terminal sets including a reference terminal in one cavity extending to both sides of said slot and a pair of identical signal terminals in said adjacent cavity;

said signal terminals being oppositely oriented and being disposed on opposite sides of said slot; and

said reference terminal having a generally planar, plate-like body including a pair of flexible spring arms extending upwardly from said body and a pair of board contacts extending downwardly from said body, the plane of said body being generally perpendicular to said longitudinal axis of said slot.

15. The card edge connector of claim **14** wherein said signal terminals have a generally planar, plate-like body and a single flexible spring arm extending upwardly from said body and a single board contact extending downwardly from said body, said body being generally perpendicular to said longitudinal axis of said slot.

16. A card edge connector for interconnecting a printed circuit board having conductive contact regions and a removable printed circuit card having a mating edge with a plurality of conductive contact pads, said card edge connector comprising:

an elongated housing formed of insulating material and having a mating surface;

an elongated slot in said mating surface of said housing for receiving said mating edge of said circuit card, said slot having an elongated centerline therealong coinciding with the center of said circuit card when mated;

a plurality of transversely extending terminal receiving cavities in said housing, each cavity extending to both sides of said slot; and

a plurality of conductive first and second terminals mounted in said cavities, said first and second terminals being differently configured, said terminals including spring arms with contact portions extending into said slot for contacting said contact pads of said circuit card when inserted therein and board contacts extending from said housing for contacting said contact regions of said circuit board, said contact portions of one of said first and second terminals being closer to said mating surface than said contact portions of the other of said first and second terminals, said first terminals being generally planar;

said board contacts for all of the first and second terminals mounted in said housing cavities being arrayed solely in four lines parallel to said centerline, said four lines including an inner line and an outer line on each side of said centerline;

wherein two of said board contacts extend from each cavity;

wherein said board contacts of said first terminals lie only in said inner lines and said board contacts of said second terminals lie only in said outer lines.

17. A card edge connector as claimed in claim **16** wherein said first terminals are reference terminals and said second terminals are signal terminals.

18. A card edge connector as claimed in claim **17** wherein each cavity containing at least one of said signal terminals is adjacent to a cavity containing at least one of said reference terminals.

19. A card edge connector as claimed in claim **18** wherein each cavity containing at least one of said signal terminals is between two cavities containing at least one of said reference terminals.

20. A card edge connector as claimed in claim **16** wherein said terminals are flat, planar stamped plates of metal.

21. A card edge connector as claimed in claim **20** wherein said board contacts are solder tails.

22. A card edge connector as claimed in claim **16** wherein each said signal terminal includes one of said spring arms and one of said board contacts and two of said signal terminals are mounted in each cavity with one of said signal terminal on each side of said slot.

23. A card edge connector as claimed in claim **16** wherein each said reference terminal includes two of said spring arms and two of said board contacts and said reference terminals are mounted one to a cavity with said spring arms and board contacts on opposite sides of said slot.

* * * * *